WHAT IS CLAIMED IS:

1. A method of applying total liquid ventilation to a patient according to a ventilation cycle including inspiration and expiration profiles, comprising:

supplying oxygenated liquid to the lungs of the patient during inspiration;

withdrawing liquid from the patient's lungs during expiration; and

controlling independently supply of oxygenated liquid to the patient's lungs and withdrawal of liquid from the patient's lungs, the supply and withdrawal independent control comprising producing a ventilation cycle having independently controlled inspiration and expiration profiles.

2. A method of applying total liquid ventilation as defined in claim 1, further comprising:

oxygenating the liquid withdrawn from the patient's lungs through an oxygenator unit; and

supplying oxygenated liquid to the patient's lungs comprises supplying to the patient's lungs oxygenated liquid from the oxygenator unit.

3. A method of applying total liquid ventilation as defined in claim 2, wherein:

supplying oxygenated liquid to the patient's lungs comprises accumulating oxygenated liquid from the oxygenator unit in an inspiration piston pump, and transferring the oxygenated liquid accumulated in the inspiration piston pump to the patient's lungs; and

withdrawing liquid from the patient's lungs comprises accumulating liquid from the patient's lungs in an expiration piston pump, and transferring the liquid accumulated in the expiration piston pump to the oxygenator unit.

4. A method of applying total liquid ventilation as defined in claim 3, further comprising:

simultaneously starting transfer of the oxygenated liquid accumulated in the inspiration piston pump to the patient's lungs and transfer of the liquid accumulated in the expiration piston pump to the oxygenator unit; and

extending a time of residence of the liquid in the oxygenator unit by transferring the liquid accumulated in the expiration piston pump to the oxygenator unit more rapidly than the oxygenated liquid accumulated in the inspiration piston pump is transferred to the patient's lungs.

5. A method of applying total liquid ventilation as defined in claim 3, further comprising:

producing a pause between (a) transfer of the oxygenated liquid accumulated in the inspiration piston pump to the patient's lungs and transfer of the liquid accumulated in the expiration piston pump to the oxygenator unit, and (b) accumulation of oxygenated liquid from the oxygenator unit in the inspiration piston pump and accumulation of liquid from the patient's lungs in the expiration piston pump.

6. A method of applying total liquid ventilation as defined in claim 3, further comprising:

producing a pause between (a) accumulation of oxygenated liquid from the oxygenator unit in the inspiration piston pump and accumulation of liquid from the patient's lungs in the expiration piston pump, and (b) transfer of the oxygenated liquid accumulated in the inspiration piston pump to the patient's lungs and transfer of the liquid accumulated in the expiration piston pump to the oxygenator unit.

7. A method of applying total liquid ventilation as defined in claim 3, further comprising:

starting accumulation of liquid from the patient's lungs in the expiration piston pump before accumulation of oxygenated liquid from the oxygenator unit in the inspiration piston pump, and

simultaneously ending accumulation of oxygenated liquid from the oxygenator unit in the inspiration piston pump, and accumulation of liquid from the patient's lungs in the expiration piston pump.

8. A method of applying total liquid ventilation as defined in claim 1, wherein the inspiration and expiration profiles are ramp profiles.

9. A method of applying total liquid ventilation as defined in claim 2, further comprising:

accumulating oxygenated liquid from the oxygenator unit in a buffer reservoir; and

measuring the level of oxygenated liquid in the buffer reservoir to detect losses of liquid or errors in volumes of liquid supplied to or withdrawn from the patient's lungs.

10. A method of applying total liquid ventilation as defined in claim 2, further comprising:

accumulating oxygenated liquid from the oxygenator unit in a buffer reservoir; and

measuring the level of oxygenated liquid in the buffer reservoir to detect a total quantity of liquid, and to determine, by deduction, the residual volume of liquid in the patient's lungs.

11. A method of applying total liquid ventilation as defined in claim 2, further comprising:

accumulating oxygenated liquid from the oxygenator unit in a buffer reservoir;

measuring the level of oxygenated liquid in the buffer reservoir;

calculating a volume of functional residual capacity from the measured level of oxygenated liquid; and

correcting said level of functional residual capacity by supplying to and withdrawing from the lungs different volumes of liquid.

12. A method of applying total liquid ventilation as defined in claim 1, wherein the liquid comprises PFC liquid.

13. A method of applying total liquid ventilation as defined in claim 1, wherein producing a ventilation cycle having independently controlled inspiration and expiration profiles comprises:

modifying, in the course of total liquid ventilation, at least one of the following parameters: the volume of oxygenated liquid supplied to the patient's lungs during inspiration, the volume of liquid withdrawn from the patient's lungs during expiration, the inspiration profile, the expiration profile, the expiration time, a pause between inspiration and expiration, and a pause between expiration and inspiration.

14. A system for applying total liquid ventilation to a patient according to a ventilation cycle including inspiration and expiration profiles, comprising:

an inspiration pump for supplying oxygenated liquid to the lungs of the patient;

an expiration pump for withdrawing liquid from the patient's lungs; and

a ventilation cycle control means comprising first and second pump controllers connected to the inspiration and expiration pumps, respectively, to control independently said inspiration and expiration pumps in order to produce a ventilation cycle having independently controlled inspiration and expiration profiles.

15. A system for applying total liquid ventilation as defined in claim 14, further comprising:

at least one oxygenator of the liquid withdrawn from the patient's lungs through the expiration pump.

16. A system for applying total liquid ventilation as defined in claim 15, further comprising:

first conduit means for connecting the inspiration and expiration pumps to the patient's airways and second conduit means for connecting the inspiration and expiration pumps to said at least one oxygenator; and

valves mounted on the first and second conduits, connected to the ventilation cycle control means, and controlled by said ventilation cycle control means.

17. A system for applying total liquid ventilation as defined in claim 15, wherein the oxygenator comprises:

a lower perforated membrane to supply oxygen to the liquid;

an inner cylindrical section having an upper end to which the liquid withdrawn from the patient's lungs is supplied;

an outer annular section separated from the inner cylindrical section by a cylindrical partition and communicating with the inner cylindrical section through an annular passage between a lower end of the cylindrical partition and the perforated membrane; and

an outlet for supplying oxygenated liquid from the annular section, said outlet being positioned at a level that determines the level of liquid in the oxygenator.

18. A system for applying total liquid ventilation as defined in claim 15, wherein:

the oxygenator is formed as a modular unit connectable to other similar oxygenator modular units;

the system for applying total liquid ventilation comprises a plurality of said modular oxygenator units connected in series and/or parallel in order to increase the capacity of oxygenation of the liquid withdrawn from the patient's lungs by the expiration pump.

19. A system for applying total liquid ventilation as defined in claim 15, wherein:

the inspiration pump comprises an inspiration piston pump for accumulating oxygenated liquid from the oxygenator, and for subsequently transferring the accumulated oxygenated liquid to the patient's lungs; and

the expiration pump comprises an expiration piston pump for accumulating liquid from the patient's lungs, and for subsequently transferring the liquid accumulated from the patient's lungs to the oxygenator.

20. A system for applying total liquid ventilation as defined in claim 15, wherein:

the oxygenator is formed as a modular unit connectable to other similar oxygenator modular units; and

each oxygenator modular unit comprises an integrated heating unit for warming the liquid at a predetermined temperature.

21. A system for applying total liquid ventilation as defined in claim 20, wherein:

the oxygenator comprises a lower tubular wall; and

the heating unit comprises a heating element wound around the lower tubular wall of the oxygenator.

22. A system for applying total liquid ventilation as defined in claim 17, further comprising:

a filter unit for filtering the liquid withdrawn from the patient's lungs before supplying it to the upper end of the inner cylindrical section of the oxygenator.

23. A system for applying total liquid ventilation as defined in claim 15, further comprising:

a filter unit for filtering the liquid withdrawn from the patient's lungs before supplying it to the oxygenator, said filter unit being integrated to the oxygenator.

24. A system for applying total liquid ventilation as defined in claim 15, further comprising:

a condenser system for recovering vapour and/or aerosol of said liquid produced from said at least one oxygenator.

25. A system for applying total liquid ventilation as defined in claim 24, wherein the condenser system comprises:

a first condenser unit supplied with the vapour and/or aerosol of said liquid for cooling said vapour and/or aerosol in order to convert said vapour and/or aerosol back to liquid; and

a second condenser unit supplied with remaining vapour and/or aerosol from the first condenser unit, for producing icing/de-icing cycles in order to convert said remaining vapour and/or aerosol back to liquid.

26. A system for applying total liquid ventilation as defined in claim 24, wherein the condenser system is integrated to one oxygenator.

27. A system for applying total liquid ventilation as defined in claim 15, further comprising:

a buffer reservoir for accumulating oxygenated liquid from the oxygenator, said buffer reservoir being connected to the inspiration pump, and said inspiration pump drawing oxygenated liquid from the buffer reservoir for supplying the patient's lungs with the so drawn oxygenated liquid.

28. A system for applying total liquid ventilation as defined in claim 27, wherein the ventilation cycle control means comprises:

means for measuring the level of oxygenated liquid in the buffer reservoir to detect losses of liquid or errors in volumes of liquid supplied to or withdrawn from the patient's lungs.

29. A system for applying total liquid ventilation as defined in claim 27, wherein the ventilation cycle control means comprises:

means for measuring the level of oxygenated liquid in the buffer reservoir to detect a total quantity of liquid, and to determine, by deduction, the residual volume of liquid in the patient's lungs.

30. A system for applying total liquid ventilation as defined in claim 27, wherein the ventilation cycle control means comprises:

means for measuring the level of oxygenated liquid in the buffer reservoir;

means for calculating a volume of functional residual capacity from the measured level of oxygenated liquid; and

means for correcting said level of functional residual capacity by supplying to and withdrawing from the lungs different volumes of liquid.

31. A system for applying total liquid ventilation as defined in claim 14, wherein the liquid comprises PFC liquid.

32. A system for applying total liquid ventilation as defined in claim 19, wherein the first and second pump controllers comprise:

means for simultaneously starting transfer of the oxygenated liquid accumulated in the inspiration piston pump to the patient's lungs and transfer of the liquid accumulated in the expiration piston pump to the oxygenator unit; and

means for extending a time of residence of the liquid in the oxygenator unit by transferring the liquid accumulated in the expiration piston pump to the oxygenator unit more rapidly than the oxygenated liquid accumulated in the inspiration piston pump is transferred to the patient's lungs.

33. A system for applying total liquid ventilation as defined in claim 19, wherein the first and second pump controllers comprise:

means for producing a pause between (a) transfer of the oxygenated liquid accumulated in the inspiration piston pump to the patient's lungs and transfer of the liquid accumulated in the expiration piston pump to the oxygenator unit, and (b) accumulation of oxygenated liquid from the oxygenator unit in the inspiration piston pump and accumulation of liquid from the patient's lungs in the expiration piston pump.

34. A system for applying total liquid ventilation as defined in claim 19, wherein the first and second pump controllers comprise:

means for producing a pause between (a) accumulation of oxygenated liquid from the oxygenator unit in the inspiration piston pump and accumulation of liquid from the patient's lungs in the expiration piston pump, and (b) transfer of the oxygenated liquid accumulated in the inspiration piston pump to the patient's lungs and transfer of the liquid accumulated in the expiration piston pump to the oxygenator unit.

35. A system for applying total liquid ventilation as defined in claim 19, wherein the first and second pump controllers comprise:

means for starting accumulation of liquid from the patient's lungs in the expiration piston pump before accumulation of oxygenated liquid from the oxygenator unit in the inspiration piston pump, and

means for simultaneously ending accumulation of oxygenated liquid from the oxygenator unit in the inspiration piston pump, and accumulation of liquid from the patient's lungs in the expiration piston pump.

36. A system for applying total liquid ventilation as defined in claim 14, wherein the first and second pump controllers comprise:

means for producing inspiration and expiration ramp profiles.

37. A system for applying total liquid ventilation as defined in claim 14, wherein the ventilation cycle control means comprises:

means for modifying, in the course of total liquid ventilation, at least one of the following parameters: the volume of oxygenated liquid supplied to the patient's lungs during inspiration, the volume of liquid withdrawn from the patient's lungs during expiration, the inspiration profile, the expiration profile, the expiration time, a pause between inspiration and expiration, and a pause between expiration and inspiration.